New Hampshire DOT
Department of Transportation

TSMO Bureau

Five-Year Strategic Plan

Fiscal Years 2020-2024

July 2018

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Appendices

List of Acronyms

ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
AVL	Automatic Vehicle Location
C2C	Center to Center
CAD	Computer Aided Dispatch
CV/AV	Connected Vehicle and Automated Vehicle
CCTV	Closed Circuit Television Cameras
DMS	Dynamic Message Sign
DoIT	Department of Information Technologies
DOS	Department of Safety
DSRC	Dedicated Short Range Communications
EOC	Emergency Operations Center
FHWA	Federal Highway Administration
ITS	Intelligent Transportation System
LMR	Land Mobile Radio
MDSS	Maintenance Decision Support System
MOU	Memorandum of Understanding
MVDS	Motor Vehicle Detection Systems
NASCAR	North American Stock Car
NHDOT	New Hampshire Department of Transportation
NHPTV	New Hampshire Public Television
ORT	Open Road Tolling
POTS	Plain Old Telephone Service
RWIS	Road Weather Information Systems
SMRPC	Southern Maine Regional Planning Commission
SOP	Standard Operating Procedure
SP	State Police
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SPO	Safety Patrol Officer
TIM	Traffic Incident Management
TMC	Transportation Management Center
TSC	Technical Steering Committee (I-93)
TSMO	Transportation Systems Management & Operations
VSL	Variable Speed Limit

1. INTRODUCTION AND BACKGROUND

New Hampshire's transportation system faces challenges from steady growth in population and freight activity. These increased demands affect both safety and mobility for travelers throughout the state. Inefficient movement reduces productivity, wastes energy, increases emissions, compromises safety, and diminishes quality of life as transportation is vital to the social and economic health of New Hampshire.

Deploying Intelligent Transportation Systems (ITS) is a strategy that can be used to address many of these issues and promote the Transportation Systems Management, and Operations (TSMO) philosophy. TSMO includes the application of advanced technologies to surface transportation problems including traffic and transportation management, travel demand management, advanced public transportation management, electronic payment, commercial vehicle operations, emergency services management, and advanced vehicle control and safety systems.

The purpose of this ITS Strategic Plan is to provide guidance on the deployments and integrations of the TSMO Bureau over the next five fiscal years (2020-2024). This Strategic Plan is an update to the previous Strategic Plan developed for fiscal years 2015 - 2019. The time frame reflects a reasonable horizon that considers major advances in emerging technologies that may alter installation methods, costs, or delivery systems in the future. The sections of this plan include:

1. Introduction – discussions of background and purpose for ITS systems and their elements

2. Strategic Plan – general means and methods to focus on in the next 5 years to fulfill the desired vision of the ITS program

Appendix A – Implementation Plan – provides future initiatives for each of the categories on a year-by-year bases

Appendix B – Project Summary Sheets – information for each significant component listed in the strategic plan in terms of Project Description, Project Lead/Champion, Schedule, Budgetary Cost Estimate, and Goals.

Appendix C – ITS Device Inventory – A summary table of devices by type and roadway, including totals and a percent increase from the previous inventory.

Appendix D – ITS Architecture – System diagrams that show physical and logical connections between New Hampshire's technology stakeholders used when developing new project concepts.

1.1 TSMO Bureau Vision

The New Hampshire Department of Transportation (NHDOT) has made significant investments in ITS to improve the operations of the State's transportation system, for both typical weekday conditions as well as unique events and holidays, such as NASCAR races or summer weekend tourism demands. In June of 2014, the NHDOT created the TSMO Bureau to oversee ITS programs and Operations at the Transportation Management Center (TMC). Since its creation, the TSMO Bureau continues to expand ITS capabilities and assist other Bureaus with technology projects.

The vision statement is the message that the NHDOT wants to deliver to the end users about what this program hopes to achieve. It is the belief of the NHDOT that ITS technologies and initiatives will create a more user-friendly experience for all travelers in New Hampshire. TSMO Bureau's Vision Statement is:

> **The use of Intelligent Transportation Systems and emerging technologies shall support the New Hampshire Department of Transportation in managing operations safely, seamlessly, and efficiently across multiple jurisdictional and agency boundaries as well as provide real-time road condition information to the public.**

Specific goals that support the Bureau's Vision outline what will be accomplished by the end of fiscal year 2024. They are divided into internal (NHDOT) and external (travelers) goals. NHDOT strives to create an internal culture that is focused on improved traveler experience.

Internal Goals

- Culture that promotes efficient ITS operations
  - Capacity building within NHDOT on ITS applications, costs and benefits
  - Multimodal ITS initiatives
  - More efficient NHDOT ITS planning processes
- TMC Operations & Maintenance capabilities
  - Improved Operator recruiting and training
  - Improved network and device maintenance capabilities
- Performance Measures
  - Adherence to established performance measurements
  - Create new performance measures as processes expand and evolve

External Goals

- Safety & Security
  - Improved transportation network safety
  - Improved incident and emergency management activities
- Coordination
  - Improved traffic management
  - Effective dissemination of traffic information
- Mobility
  - Reduced recurring and non-recurring congestion

- More efficient modal utilization

As projects and programs are moved forward in the next five years in support of these goals, certain objectives are expected to be met:

Internal Objectives

- TSMO will implement ITS initiatives in a strategic and cost effective manner through mainstreaming and multimodal corridor deployments.
- TSMO operations and maintenance will show improvement as measured through established performance measures.

External Objectives

- Traveler delays on Interstates and major arterial routes will be minimized through rapid detection, response, and clearance of incidents and debris.
- Travelers will be able to avoid delays on major routes with a significant amount of accurate pre-travel and en-route information regarding work zones, congested areas, and incident locations.
- Travelers will be able to make better informed decisions about trip modes, routes, and durations because they will have improved access to current traffic conditions and public transportation options.
- Work Zone strategies will reduce crashes in work zones, construction sites, and other high-crash locations through advance warnings and effective speed control during occurrences that typically increase crash rates.
- TSMO strategies will respond to changing traffic conditions in real time by equipping TMC Operators with complete information on NHDOT's transportation assets.

In summary, this Strategic Plan provides specific initiatives for projects, processes, and strategies needed to achieve the TSMO Bureau goals. The initiatives outlined in this plan should be considered during the development of future contracts and program updates. The progress on individual initiatives will be tracked and evaluated on an annual basis to ensure they are being completed in accordance with this plan.

1.2 Performance Measures

The Federal Highway Administration (FHWA) passed the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) in 2009 that includes the Real-Time System Management Information Program in Section 1201. As a part of this program, NHDOT is required to monitor real-time traffic and travel conditions on all Interstate routes and provide it to the traveling public (see Figure on next page). This is accomplished through a combination of ITS sensors, TMC Operators, and third party data. Performance measures developed from the Section 1201 rule are listed in Table 1.

Table 1: TSMO Bureau Performance Measures

Objective	Measure	Units
TSMO public notification for weather, construction, and other events	Percent of the time meeting the notification timeframe	Percent of compliance
Increase mobility	Travel time delay	Percent
	Combined uptime of field ITS devices (RWIS, DMS, MVDS, CCTV, VSL)	Percent
Improve system safety and security	Percent of events meeting notification timeframe	Percent
	Traffic incidents managed by TSMO	Number
	Number of DMS messages	Number
Identify, communication, and collaborate with partners	Number of NHTMC.com users	Number

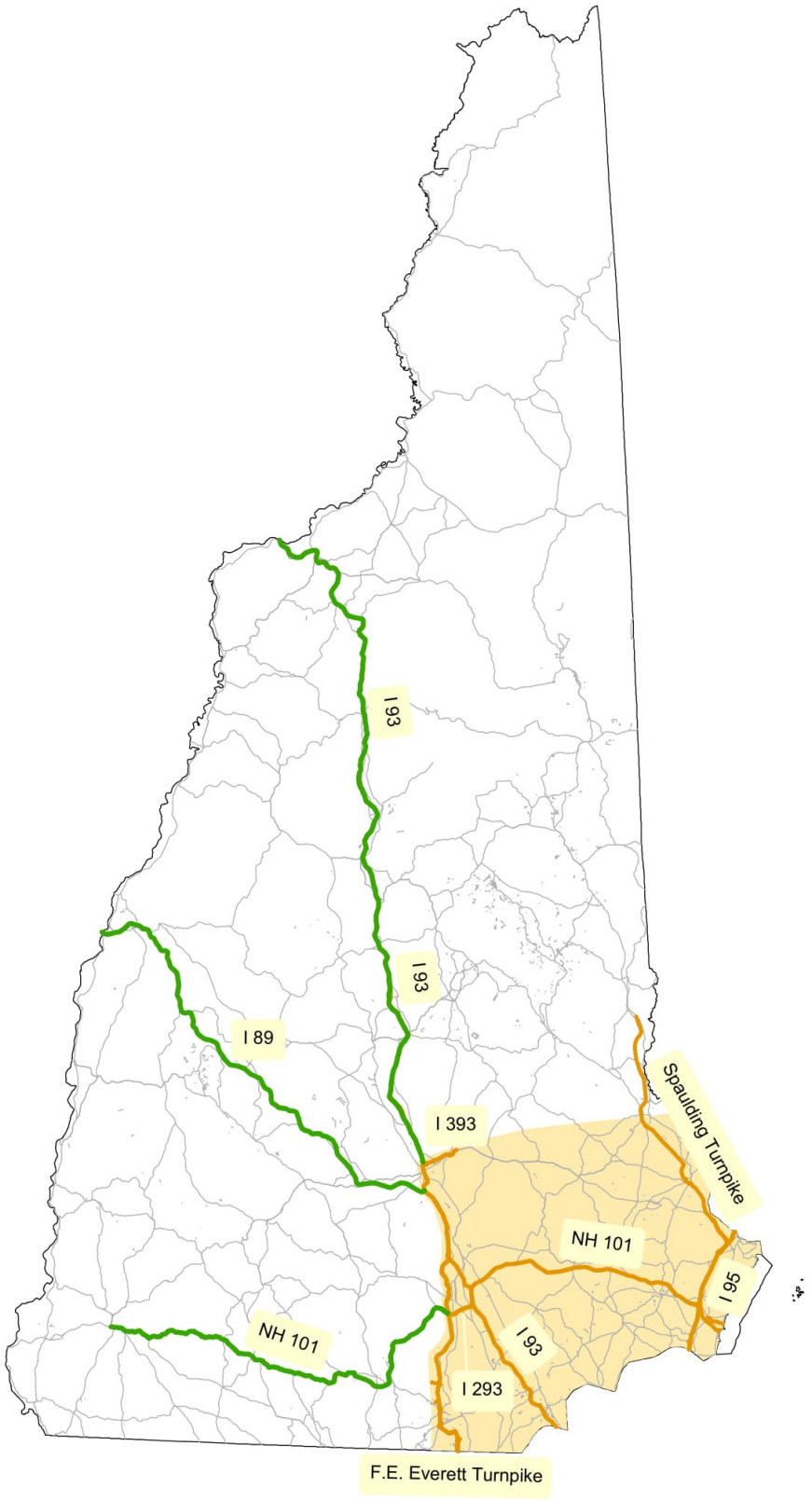
1201 Compliance Routes Map

Legend

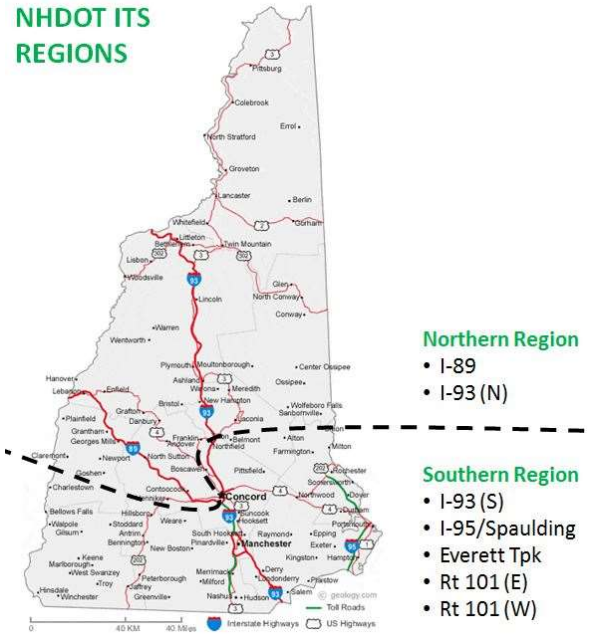
- 10 Minute Routes
- 20 Minute Routes
- Approximate MSA

Routes

Everett Turnpike
I-293
I-393
I-89
I-93
I-95 (Blue Start Turnpike)
NH 101
Spaulding Turnpike



1.3 ITS Regions



Because it is impractical to deploy ITS in the near future throughout the entire state's six corridors, two primary regions (see Figure on left) have been identified; the Southern/Urban Region, and the Northern/Rural Region. It is important to note that the two ITS Regions have differing ITS requirements as well as common ITS requirements. Many of the ITS inventory elements and services detailed in this Architecture span both regions. Generally, each region includes controlled access highways and adjacent arterial highways.

Southern Region

The TSMO Bureau generally uses a full ITS corridor approach to build out fiber or microwave backbones and then backfills the corridor with a mainstreaming approach to add additional devices. Details on specific corridors include:

I-93 Southern Corridor

This corridor encompasses I-93 from the Massachusetts state line to Exit 20 north of Concord, the Everett Turnpike, and I-293 around Manchester. This corridor is a major artery for commuter traffic from Manchester to Boston as well as a primary corridor for tourism-based traffic to northern New Hampshire. The route connects with the Everett Turnpike to the north of Manchester as well as with Route 101 on the east side of the city.

I-95 / Spaulding Turnpike Corridor

This eastern corridor serves as the major connecting road between the states of Massachusetts and Maine and encompasses I-95 from Massachusetts to Maine, the Spaulding Turnpike, and US Route 1. This turnpike facility also parallels the seacoast and, as such, is the major artery for tourism-based traffic to the New Hampshire coast. The route also connects with several major highways in NH, including NH 101 and US 4. Two toll plazas are located in Hampton, one for main line traffic and one for vehicles entering and leaving the I-95 corridor. The Hampton toll plaza currently operates in an Open Road Tolling (ORT) configuration.

The Spaulding Turnpike segment of the Turnpike System extends from Portsmouth to Exit 18 in Milton. This segment of the Turnpike System connects I-95 to NH 16 (the major roadway to northern New Hampshire in the eastern portion of the state), and it connects the major cities of eastern New Hampshire (Portsmouth, Dover and Rochester) as well as several major highways (NH 16, NH 125, and I-95). It has two toll plazas located at Dover and Rochester.

F.E. Everett Turnpike Central Corridor

This corridor extends from the Massachusetts state line in Nashua to Exit 14 in Concord. In part, it comprises a portion of U.S. Interstate Highways I-93 and I-293. The F. E. Everett Turnpike connects three New Hampshire urban centers: the cities of Concord, Manchester and Nashua. In addition, this corridor connects with three major East-West roads; NH 101, US 4 and I-89. F.E. Everett Turnpike is a toll road with two mainline plazas (Bedford and Hooksett) and two exit ramp plazas (Exit 10 and Exit 11 in Merrimack). The Hooksett toll plaza currently operates in an ORT configuration.

NH Route 101

NH Route 101 (East) -This portion of the corridor provides an east-west connection from the I-93 Corridor to the I-95 Corridor. This route experienced the largest growth in traffic volumes since its upgrade in the mid-1990's and connects the two largest metropolitan areas in the state, Manchester and Portsmouth.

NH Route 101 (West) - This portion of the corridor provides an east-west connection from the I-93 Corridor to the City of Keene. The corridor continues west of Keene to the Vermont State line as NH 9. NH 9 connects the City of Keene with I-91 in Vermont, north of Brattleboro.

Northern Region

I-89 Corridor

The north-south connection from I-93 in Concord to White River Junction in Vermont is a major corridor passing through the City of Lebanon, NH before crossing the Connecticut River at the Vermont State line and connecting to I-91.

I-93 Corridor

The I-93 portion of the Northern Corridor begins at Exit 20 in Tilton and extends to the Town of Littleton at the Vermont State border. This corridor passes through the White Mountain National Forest, from the Town of Lincoln to the Town of Franconia.

1.4 New England Compass ("Compass")

The TSMO Bureau is responsible for the Compass software system that includes shared resources with the Maine Department of Transportation and the Vermont Agency of Transportation (see figure below). This system includes three components:

1. Advanced Transportation Management System (ATMS) – This includes both ITS devices deployed on the roadway and their software interfaces, monitored at the TMC.
2. Data Hub – This combines all roadway data in a single platform that supports the system and can be used for analysis and reports.
3. Advanced Traveler Information System (ATIS) – this is the website "front-end" that allows travelers to view roadway information: http://www.newengland511.org/

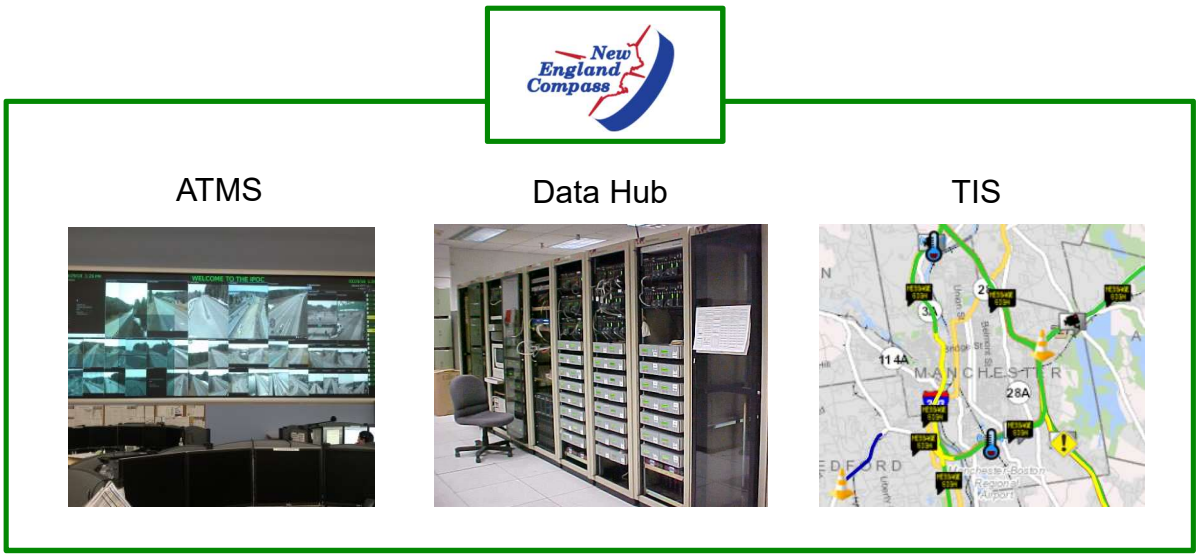


Figure: Compass Attributes

2. STRATEGIC PLAN

The Strategic Plan is presented in terms of existing conditions and future initiatives, keeping in mind the steps necessary to achieve desired capabilities of each key component of the TSMO Bureau over the next 5-year period. The specific components are broken into 10 distinct categories:

1. ITS Infrastructure and Device Deployment
2. TMC Operations
3. Maintenance of ITS Assets
4. Communications Network
5. Traveler Information Systems (TIS)
6. Traffic Incident Management (TIM)
7. Public Outreach
8. Performance Measures
9. Transit and Bridge Recordings
10. Emerging Technologies

2.1 ITS Infrastructure and Device Deployment

NHDOT currently has the following ITS infrastructure and devices deployed:

- Closed Circuit Television (CCTV) cameras
- Dynamic Message Signs (DMS)
- Variable Speed Limit (VSL) signs
- Motor Vehicle Detection Systems (MVDS)
- Road Weather Information Systems (RWIS)
- Communications Infrastructure including fiber optic cable and wireless microwave.

The field devices serve as the primary method of collecting/monitoring of roadway conditions (via CCTV and RWIS) and dissemination of information to travelers (via DMS, VSL, social media, and Compass). DMS and VSLs are used to communicate messages and reduced speeds from TMC Operators to the travelling public. The field devices also provide TMC Operators with real-time information related to traffic and roadway conditions. The CCTV cameras and RWIS sensors provide Operators a clear picture of traffic flow and weather conditions on major roadways. MVDS capture traffic volume information that is used as a valuable planning tool for designing and managing NHDOT's highway infrastructure. Appendix C contains information on the existing field devices by roadway.

Existing RWIS

ITS Infrastructure 'Needs'

The following 'need' areas were determined from meetings with TSMO Bureau leadership:

- Improved implementation planning
- Leverage devices for multiple uses
- Scaled infrastructure deployments based on roadway characteristics
- Deployments closely tied to benefit-cost analysis
- Additional CCTV coverage
- Additional RWIS coverage
- Device and communications inventory / asset management
- Connected / Automated Vehicle infrastructure assessment

The TSMO Bureau uses two primary approaches to deploying ITS Infrastructure:

Corridor – ITS field devices and the associated communications infrastructure are built as part of a single stand-alone project.

Mainstreaming – The systematic approach to consider ITS deployments during the project design phases of larger roadway and bridge infrastructure projects. This approach allows for more efficient and cost effective deployments. For example, taking advantage of lower earth disturbance costs and lower concrete costs as higher quantities are purchased for the project will help reduce costs. This approach consolidates two potential projects into a single project, which reduces impacts to travelers. This approach to 'mainstream' ITS infrastructure is currently being utilized as the opportunities present themselves.

Existing DMS

In addition to 'corridor' and 'mainstreaming' projects, the expansion of ITS devices can also be prioritized based on crash locations, congested segments, and other guidance established by the ITS Oversight Committee (i.e. high crash locations, high levels of traffic congestions, and availability of fiber optic or microwave communication networks). This approach allows flexibility in the deployment of ITS to meet emerging needs.

Proposed ITS Infrastructure Projects (See Appendix A – Implementation Plan)

I-1: Project Specific Mainstreaming
I-2: NH 101 Master Plan
I-3: I-93 North of Concord Master Plan
I-4: Everett Turnpike ATMS
I-5: RWIS Deployment
I-6: Turnpike ATMS Gaps
I-7: Rural ITS Strategic plan
I-8: Transit Master Plan Mainstreaming Development
I-9: Traffic Signal Connectivity
I-10: Work Zone ITS Deployments

2.2 TMC Operations

Since its opening in 2007, the TMC places mobility and emergency response Operators and managers in a single collaborative environment. The center operates 24 hours per day, 365 days per year. Operators manage traffic at the TMC by coordinating with incident responders, controlling ITS equipment, and developing and implementing response plans. TMC operations are primarily responsible for:

- *Traffic Incident Management* – TMC Operators are responsible for detecting, verifying and responding to incident information. Operators document, activate, and update information in Compass. Operators notify emergency response and dispatch personnel if not already on scene, and provide updates to internal and external stakeholders. The TMC Operator's role prior to, during, and after an incident varies based on the type and severity of the incident.

NHDOT Transportation Management Center

- *Recurring Traffic Management* – Regularly occurring congestion on high demand roadways or through work zones during construction and maintenance projects is managed by the TMC as planned events. Operators process event information through the same systems as singular traffic incidents, thereby promoting safety and increasing mobility for typical travel throughout the state.

- *Security Management* – Cameras used for security purposes, such as those located at the Portsmouth Bridges, or the Transit Centers throughout the state, are able to be monitored by TMC Operators.
- *Road and Weather Management* – TMC Operators are responsible for monitoring weather conditions via forecasted weather services, RWIS, and CCTV. Information is provided to motorists via DMS, social media, and ATIS/511. NHDOT utilizes Automatic Vehicle Location (AVL) devices and a Maintenance Decision Support System (MDSS) that serve as data inputs to adverse weather operations. Operators monitor RWIS sites for rainfall accumulation and notify environmental staff to activate turbidity monitoring when readings reach pre-determined levels.
- *Safety Patrol Management* – Safety Patrol Officers (SPOs) notify TMC Operators when they are responding to incidents, break-downs, or road debris. TMC Operators have a range of responses from documenting the incident to posting messages on a DMS as needed.
- *Emergency Operations* – TMC Operators support Emergency Operations Center (EOC) operations during events such as flooding or severe weather events. For example, during icy conditions the TMC will post weather messaging.
- *Special Event Management* – TMC Operators support special events by improving traffic flow in the areas to, from, and around the event by communicating through DMS boards, monitoring impacts, and posting information on social media networks.
- *Equipment monitoring* – ITS equipment in the field is monitored by the Department of Information Technology (DoIT) and TSMO, and routinely evaluated for possible malfunction. This includes monitoring the image and video delivery of CCTVs, and ensuring messages are displayed on DMS boards correctly.
- *ATMS System Testing* - TMC Operators work with the ITS design engineers to participate in acceptance testing of the ATMS system software used for TMC Operations.
- *Amber Alerts* – TMC Operators are responsible for posting Amber Alerts in accordance with Federal and State policy.

<u>TMC Operations 'Needs'</u>

The following 'need' areas were determined from meetings with TSMO Bureau leadership:

- Enhanced Weather Situational Awareness
- TMC Operations staffing
- TMC Operator training
- Transit coordination
- Remote view of signal systems

CCTV Routine Maintenance

<u>Proposed TMC Operations Projects (See Appendix A – Implementation Plan)</u>

TMC-1: Continuity of Operations (COOP) Plan
TMC-2: Operator Training Curriculum
TMC-3: TMC Standard Operating Procedures
TMC-4: Compass Enhancements
TMC-5: Winter Weather Communication Conference

TMC-6: TMC Network Upgrade and Maintenance Plan

These projects will continue to improve TMC Operations and enhance the traveler experience by reducing the overall delays related to incident, construction activities, everyday congestion, and weather related activities.

2.3 Maintenance of ITS Assets

Although the initial focus of the ITS program was physical deployment, this is shifting to include maintaining existing equipment as the system continues to be built out. It is anticipated that the shift will be reflected in the amount of funding and resources assigned to maintenance versus installation.

ITS Maintenance 'Needs'

The following 'need' areas were determined from meetings with TSMO Bureau leadership:

- Additional resources including personnel and funding
- Additional training for personnel
- Resource Inventory
- Lifecycle cost tracking and maintenance plan
- Tracking device uptime

Proposed ITS Maintenance Projects (See Appendix A – Implementation Plan)

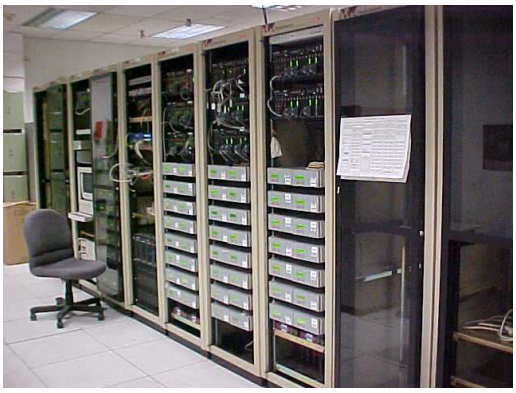
The following initiatives are proposed to improve the efficiency of ITS maintenance activities. Efficient maintenance will be necessary to continue the reliability of ITS systems as they grow through deployments.

M-1: ITS Infrastructure Maintenance Plan
M-2: Maintenance Inventory and Work Order Tracking System
M-3: Maintenance Personnel Training
M-4: New Maintenance Facility

These projects will result in higher ITS availability through improved reliability and reduced costs through rational ITS equipment replacement. In the future, a strategy will be developed to replace outdated equipment with better and more cost effective equipment. Strategies that control the increasing annual cost of maintaining and replacing legacy ITS equipment will be needed.

2.4 Communications Network

The current ITS communications network provides a means for ITS field devices to connect to various systems located at the TMC and the Compass hosting facility. The communications system is comprised of the following components:



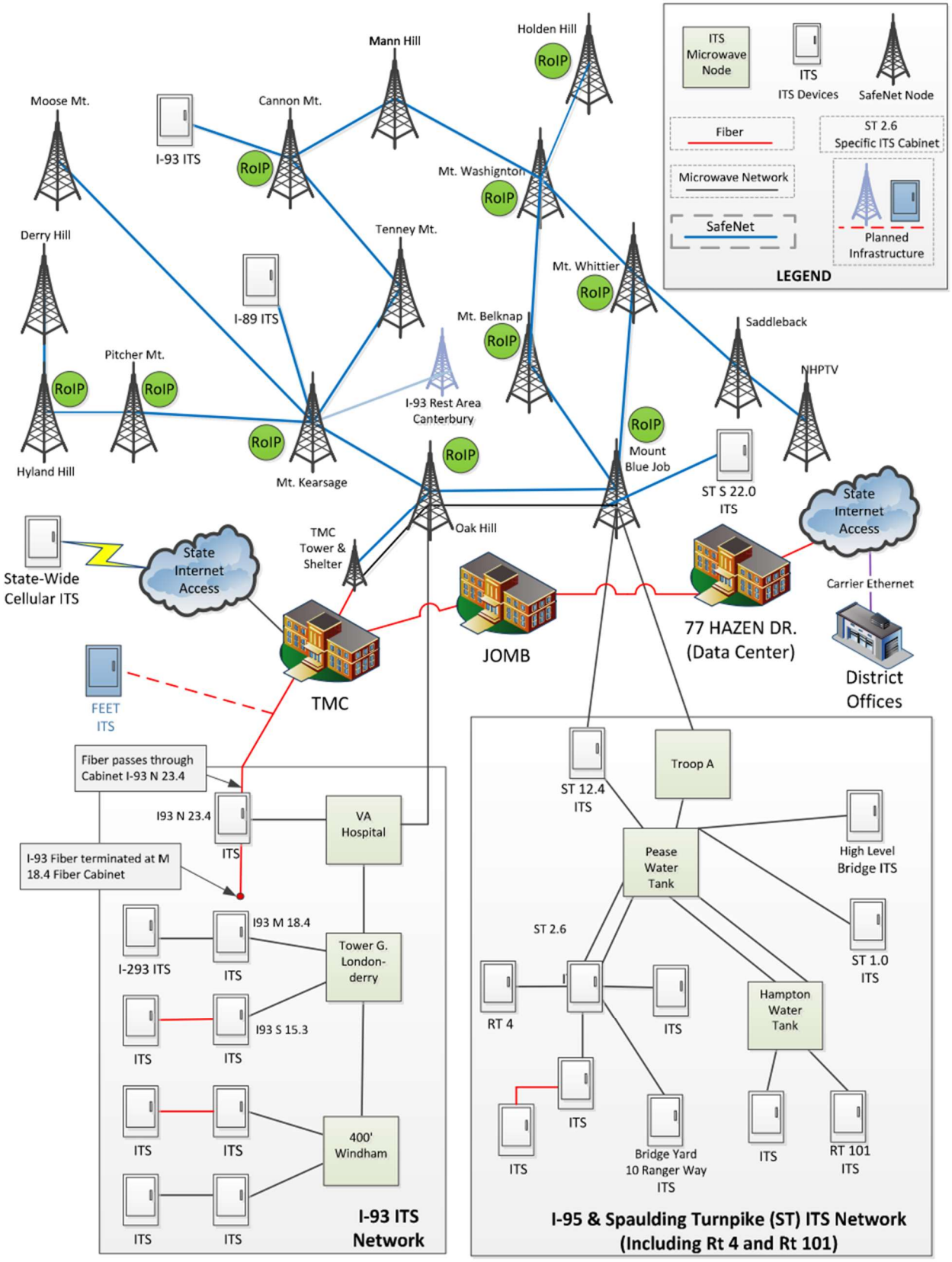
TMC Server Room

- ITS supporting hardware includes:
  - Redundant Firewalls
  - Ethernet Switches
  - File Servers (local and hosted)
  - Workstations
  - Video Wall hardware
- Communications Network - The communication system facilitates data exchange between the ITS field devices, the TSMO network, and software systems. The current ITS network is comprised of fiber optic infrastructure, microwave, and wireless cell modems.
- Data Archive - Data collected from ITS devices and Dispatching Logs are archived in Compass and are stored at the Compass hosting facility. Operations documentation, policies and procedures are stored locally at the TMC.
- ITS Systems Standards Development - Standard ITS specifications and details allow for standardized procurements, consistent requirements, seamless device integration into Compass and other TSMO systems.

The TSMO primary communications infrastructure types available for ITS use are:

- Fiber Optic Cable
- Wireless Microwave
- Cellular Providers
- Cable Internet Service Providers (ISP)
- Carrier Ethernet (ISP)

The TSMO ITS fiber optic and microwave networks are state owned and operated. Installing fiber optic infrastructure during construction projects to extend the existing state owned fiber is the best long term strategy for large bandwidth data conveyance reliability. Once fiber is installed there are no recurring lease costs for fast and reliable communications infrastructure. A Shared Resources Public-Private Partnership (P3) can provide another means to extend fiber in the state. In addition to state owned fiber there are carrier Ethernet, cellular and cable providers who offer leasing of communications infrastructure. In areas where fiber optic and microwave communications are not feasible other providers can be used. However, Cellular deployments must be considered on a case by case basis due to New Hampshires mountainous terrain and cable or carrier Ethernet providers may not offer services at all desired locations. While wireless microwave networking is a cost effective method for ITS device communications it often requires leasing tower space, a recurring cost that state owned fiber does not require.



NHDOT Communication Diagram (Statewide Communications Study)

ITS System/Communications Network 'Needs'

The following 'need' areas were determined from meetings with TSMO Bureau leadership:

- Considerations for Connected Vehicles such as Dedicated Short Range Communications (DSRC)
- Availability of 24/7 Support
- Network redundancy

Proposed ITS System/Communications Network Projects (See Appendix A – Implementation Plan)

The network is incomplete from a statewide perspective. Several projects currently underway are attempting to close some of the gaps and expand data sharing. Additional projects that should be moved forward in the next 5 years include:

N-1: Communication Network Expansion
N-2: Shared Resource Program
N-3: ITS Standards Program
N-4: Network Monitoring Review and Software Upgrade
N-5: Land Mobile Radio (LMR) Asset Management System

These projects will improve the existing communications networks as well as enhance future initiatives. They will provide a continuing consistent roadmap of systems used/needed to support the growing ITS infrastructure.

2.5 Traveler Information Systems (TIS)

Traveler information dissemination is a significant component of an effective traffic management program. By informing travelers of incident or delay information, efficiencies could result in improved emergency response times, alternative routing, a reduced number of secondary accidents, and reduced delays for commuters and freight traffic. The TMC uses an array of tools to communicate traffic considerations to travelers throughout the state which include:

- DMS – Message boards are used to display incident, construction work zone information or expected delays.
- VSLs communicate reduced speed limits when necessary.
- Social Media – Twitter is used to communicate updates to travelers that subscribe to specific feeds associated with the following corridors: I-89, I-93, I-95, NH 101 between Manchester and Hampton, F.E. Everett Turnpike, and the Spaulding Turnpike (I-293). The messages update travelers on corridor-related information such as poor weather, events, and traffic delays.
- Traveler Information Web Services – TMC Operators update a 511 website (Compass) that displays to travelers real time traffic information. This website is accessed through

the portal at http://newengland511.org/. Examples include construction projects, road closures such as parades, and traffic congestion levels.

New England 511 Webpage showing Travel Speed during Incident Response

Traveler Information Systems 'Needs'

The following 'need' areas were determined from meetings with TSMO Bureau leadership:

- Coordination of traveler information providers
- Fill in traveler information gaps
- Efficient information gathering & dissemination

Proposed Traveler Information Systems Projects (See Appendix A – Implementation Plan)

Traveler Information Systems is constantly evolving and thereby creating new opportunities to share data and information with stakeholders and the traveling public. Areas of focus for the next 5 years include:

TIS-1: Travel Time Data Review
TIS-2: Travel Time Deployments
TIS-3: Advanced Notifications for Unplanned Events

2.6 Traffic Incident Management (TIM)

Managing traffic involves both responding to incidents and operational scenarios. Traffic management is an important tool in lessening the impact of congestion as well as providing for a safer environment for drivers. It is a coordination process to detect, respond to, and remove traffic incidents and restore traffic capacity as safely and quickly as possible. The coordination

process can include a range of public and private sector response partners from local and state law enforcement to television and radio media companies.

Several tools are utilized during a traffic incident, depending on the type and severity of incident. These include:

On-scene TIM Coordination

- Through Traveler Information via DMS, social media networks, and on the Compass website, travelers are advised of approaching conditions and can make informed decisions regarding alternative routes.
- Safety Patrols currently serve the I-93 Salem to Manchester Corridor (Exit 1 through 5), the I-95 Corridor from the Massachusetts to Maine border, the Spaulding Turnpike from Exit 1 through 9 (Portsmouth to Dover) and the Everett Turnpike from Nashua to Concord (Exit 1 through 15). The SPO often serve as the first or only responders to incidents on those roadways.
- Diversion plans are a means to reroute traffic when incidents result in serious congestion, or lane or road closures. These plans are being developed in collaboration with local planning agencies such as the I-93 Technical Steering Committee (TSC), TIM, and Southern Maine Regional Planning Commission (SMRPC), as well as responders such as police and fire to ensure that routes have adequate capacity should the need arise.
- State and local response agencies directly communicate with TMC Operators via radio, phone, or email for traffic management efforts so that TMC Operators can dispatch and deploy DOT personnel and resources.

Traffic Incident Management 'Needs'

The following 'need' areas were determined from meetings with TSMO Bureau leadership:

- Coordination of Freeway and Arterial Operations
- Work Zone Incident Management

Proposed Traffic Incident Management Projects (See Appendix A – Implementation Plan)

Effective Traffic Incident Management activities rely on both the appropriate use of technology and inter-agency coordination. The strategies that were developed are a mix of both 'technology' projects and 'people-focused' projects. Recommended initiatives include:

TIM-1: After Action Review Program
TIM-2: Interagency Agreements & Memorandums of Understanding (MOUs)
TIM-3: Diversion & Alternate Route Planning
TIM-4: Work Zone Crash Reporting
TIM-5: State Police (SP) Computer Aided Dispatch (CAD) Enhancements
TIM-6: ITS Work Zone Toolbox Update

2.7 Partnering and Public Outreach

The full potential of the ITS program will be realized by how well the TMC partners with other NHDOT sections as well as private and public organizations. Currently the TMC is co-located with the Department of Safety (DOS), the Department of Homeland Security, 911, and the Office of the State Fire Marshal which provides more effective multiagency integration.

Current ongoing efforts involve coordinating with five partners to share a private/public microwave communications network. This sharing expands communications by sharing radio capabilities, microwave communications towers, and high speed fiber optic lines.
Partners include:

1. NHDOT
2. The Department of Safety
3. Division of Economic Development
4. Division of Travel and Tourism Development
5. The National Guard
6. New Hampshire Public Television (NHPTV)

Other efforts include educating the public about the presence and benefits of ITS in New Hampshire. Continued public outreach will demonstrate to the public that sound investments are being made in transportation technology.

Partnering and Public Outreach 'Needs'

The following 'need' areas were determined from meetings with TSMO Bureau leadership:

- Cross training of departments/agencies
- Communicate 'Benefits of ITS'

Proposed Partnering/Public Outreach Projects (See Appendix A – Implementation Plan)

Continued stakeholder partnering and public outreach will demonstrate that sound investments are being made in transportation technology. The coordination and exchange of information to both partners and the public is an essential part of a successful ITS program. Some projects for consideration in this arena include:

P-1: Public Outreach Committee
P-2: ITS Awareness Campaign

2.8 Performance Measures

The full potential of the ITS and TMC operational programs are captured through a performance measurement reporting program. The TSMO Bureau has been tracking performance measures and creating reports for the past several years. The goal is to now expand on these measures to

ensure they are improving as well as identify new operational areas where new performance measures could be beneficial.

Performance Measure 'Needs'

The following 'need' areas were determined from meetings with TSMO Bureau leadership:

- A larger-scale look of performance over time to ensure improvement
- A process for collecting, analyzing and presenting new performance measure data

Proposed Performance Measure Projects (See Appendix A – Implementation Plan)

A monthly activity report captures TMC activity measures and this report is distributed internally to stakeholders. It is published externally on the TMC dashboard carried on the www.nhtmc.com webpage. A report that provides overall activity and outcome measures that are geared to internal department stakeholders will be published quarterly. All performance measures are in accordance with FHWA's 1201 rule discussed in Section 1.2. Performance Measure projects include:

PM-1: Activity Measures
PM-2: Corporate Measures
PM-3: Safety Patrol Measures

2.9 Transit and Bridge Recordings

The TSMO Bureau has been tasked with maintaining recordings from the Bureau of Rail and Transit. Additionally, the TSMO Bureau's ITS Maintenance Staff will be maintaining the communications infrastructure. Bridges being monitored include the Sarah Long, Memorial, and High Level in Portsmouth, as well as the Little Bay Bridge in Newington. Types of cameras include operational cameras for lift bridge activity, security cameras to monitor the superstructure and substructure of the bridges, and traffic cameras to monitor traffic on the bridges and incident management. There are a total of 52 bridge cameras.

Transit and Bridge Recordings 'Needs'

The following 'need' areas were determined from meetings with TSMO Bureau leadership:

- A defined scope of video recall within NHDOT, roles, responsibilities, and costs to maintain the system
- Determining required communications infrastructure required to operate the system

Transit and Bridge Recordings Projects (See Appendix A – Implementation Plan)

The Transit and Bridge recording projects include:

TBR-1: Transit Maintenance of Infrastructure
TBR-2: Transit Maintenance of Communication
TBR-3: Bridge Maintenance of Infrastructure
TBR-4: Bridge Maintenance of Communication

2.10 Emerging Technologies

The transportation industry is entering a transformative period with new and emerging technologies, especially related to Connected and Automated Vehicles (CV/AVs). These technologies will involve many state departments and will have a significant focus on the NHDOT and the TSMO Bureau.

NHDOT has been in a data-gathering period and learning lessons from other public agencies as well as technology designers and suppliers. These technologies are coming, and NHDOT needs to understand what its capabilities are and what cost-effective solutions can be implemented to work with the technologies to achieve the vision of zero roadway fatalities.

Emerging Technologies 'Needs'

The following 'need' areas were determined from meetings with TSMO Bureau leadership:

- Determining TSMO's role for implementing and monitoring CV/AV technologies
- Understanding National and State legislation and policy
- Knowledge of emerging devices and required infrastructure
- Develop a multiagency work group
- Develop Part Time Shoulder Use (PSTU)

Emerging Technologies Projects (See Appendix A – Implementation Plan)

Emerging technology projects will span various agencies and stakeholders, so it is essential that planning includes all involved and is well communicated to the public. Four recommended initiatives cover the process of first introducing CV/AV concepts to using real infrastructure on the State's roadways.

Recommended initiatives include:

ET-1: CV/AV Committee Support Materials
ET-2: CV/AV Roadmap
ET-3: CV/AV Concept of Operations
ET-4: CV/AV Infrastructure Deployment